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MSU uses $3 million NASA grant to find better ways to regulate dams

Michigan State University researchers, equipped with $3 million from NASA, will investigate innovative methods to improve dams so that they are less harmful to people and the environment.

Focusing on the Lower Mekong River Basin in Southeast Asia, the world’s largest freshwater fishery and home to 60 million people, two three-year projects will use remote sensing and on-the-ground interviews with local residents to create better policies for future dams.

Yadu Pokhrel, assistant professor of civil and environmental engineering, is among the MSU scientists who are examining ways to generate enough environmentally and socially sustainable energy to accommodate the world’s growing population. He is the co-primary investigator on the project, funded with two NASA grants totaling $3 million.

“Our goal is to provide a better understanding of how the planned dams would affect the livelihood of people in the region and recommend better and sustainable ways to design these dams,” he said.

Pokhrel’s computer model of hydrology and dam regulation will help the researchers understand what happens when river flows change due to climate change or the construction of large dams. His previous research successfully used the model to study the impact of dams in the western United States. He is also using the computer model to study the sustainability of hydropower dams in the Amazon River Basin in Brazil in a separate project funded by the National Science Foundation.

“Our model will generate the necessary information about the changes in hydrology in the downstream of the dams,” Pokhrel continued. “This will be the basis for examining the potential impacts on the livelihood of rural communities. Ultimately, our goal is to find better and sustainable ways to design the new dams.”
Pokhrel noted that, while dams are increasingly being removed in the U.S. due to their negative hydrological, environmental, and ecological impacts, there is a boom in dam construction in the developing world.

“The Mekong River in southeast Asia – which is shared by China, Myanmar, Laos, Thailand, Cambodia, and Vietnam – is one where hundreds of large hydropower dams are planned for the immediate future. The regulation of river flow generated by these large dams could severely alter the natural river flow patterns and cause a permanent and irreversible damage to fishery and agricultural systems that millions of people rely on,” he said.

“Food security for 60 million inhabitants could be severely threatened by these dams,” he added.

MSU research along the Mekong River

Dam building “is booming,” said MSU’s Daniel Kramer.

“This project is really about trying to maintain this balance, to meet this goal of sustainability, where we can provide the food we need, the energy we need, without devastating the environment in the process,” said Kramer, professor of fisheries and wildlife and James Madison College and a co-investigator on the research.

With the project, Kramer will collaborate with Pokhrel and co-principal investigator Jiaguo Qi, professor of geography, other scientists from MSU, researchers from Virginia Tech, Applied Geosolutions LLC in New Hampshire, and partners from countries in the Lower Mekong region.

The first grant will develop technologies to analyze the latest forms of satellite imagery – using active microwave technology – to understand the impact of dam construction on regional ecosystems.

Models calibrated with remotely sensed data will simulate historical water flows and project how those flows may change as a result of dam construction and shrinking glaciers in the Himalayan headwaters due to climate change.

The second grant will apply a social science approach through interviewing residents of communities surrounding and downstream from dams. The approach will focus on the community tradeoffs resulting from dams, such as economic benefits and the loss of wetland areas.

“The second project is investigating from the bottom-up how these changes are affecting people in depth using ethnographic and participatory methods,” Kramer said. “Then, we use this understanding and marry it to our typical satellite imagery approach to better understand these changes.”

Ultimately, he said, the project aims to not only reduce dams’ negative impact on surrounding communities and ecosystems, but also to generate insights to improve the planning of future dams.

“This effort serves to understand what the downstream effects of dams might be, with the hopes that we can apply this knowledge more generally to other places that are also seeing this rapid construction of dams,” Kramer said.

Other MSU researchers involved in the project are Peilei Fan, David Hyndman, William McConnell, Joseph Messina,
Jinhua Zhao, and Daniel Ahlquist.

Read more on the threats to the Mekong region at: YaleEnvironment360

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